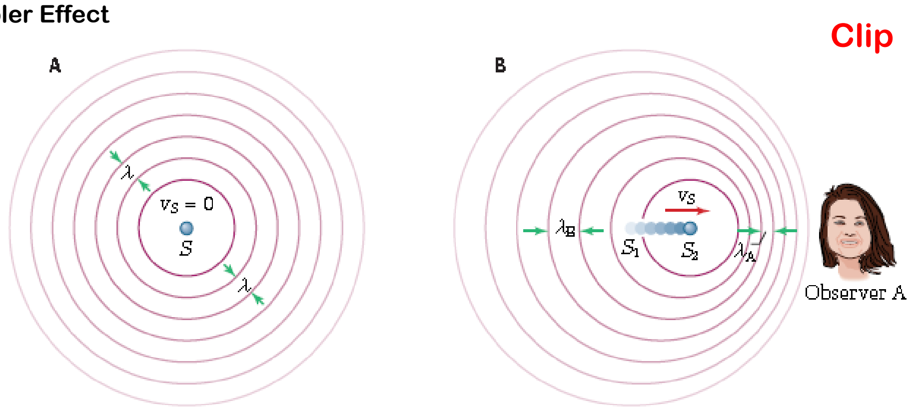
Doppler Effect



http://whs.wsd.wednet.edu/Faculty/Busse/MathHomePage/busseclasses/physics/studyguides/cha
12/Chapter12StudyGuide2010.html

Feb 12-5:01 PM

Sound Source Moving

$$f' = f\left(\frac{1}{1 \mp \frac{v_s}{v}}\right)$$

f is the frequency of the source

v is the speed of sound

v_s is the speed of the source

Use the – for moving toward and + for moving away.

Observer Moving

$$f' = f\left(1 \pm \frac{v_0}{v}\right)$$

f is the frequency of the source

v is the speed of sound

v_o is the speed of the observer

Use the + for moving toward and – for moving away

Both Source and Observer Moving

$$f' = f\left(\frac{1 \pm \frac{v_o}{v}}{1 \mp \frac{v_s}{v}}\right)$$

Use the top signs for moving towards and the bottom sign for moving away.

Feb 12-7:24 PM

Observer Moving

$$f' = f\left(1 \pm \frac{v_0}{v}\right)$$

f is the frequency of the source

v is the speed of sound

v_o is the speed of the observer

Use the + for moving toward and – for moving away

Example 1

A high speed train is traveling at a speed of 44.7 m/s when the engineer sounds the 415 Hz warning horn. The speed of sound is 343 m/s. What are the frequency and wavelength of the sound, as perceived by a person standing at a crossing when the train is (a) approaching and (b) leaving the crossing?

Example 2

A bicyclist and a car have the same speed and are moving toward each other. The car emits a sound of frequency 612.0 Hz, and the bicyclist hears the frequency as 635.0 Hz. The temperature at the time was 20°C. How fast is each going?

Feb 12-7:27 PM

Sonic Booms

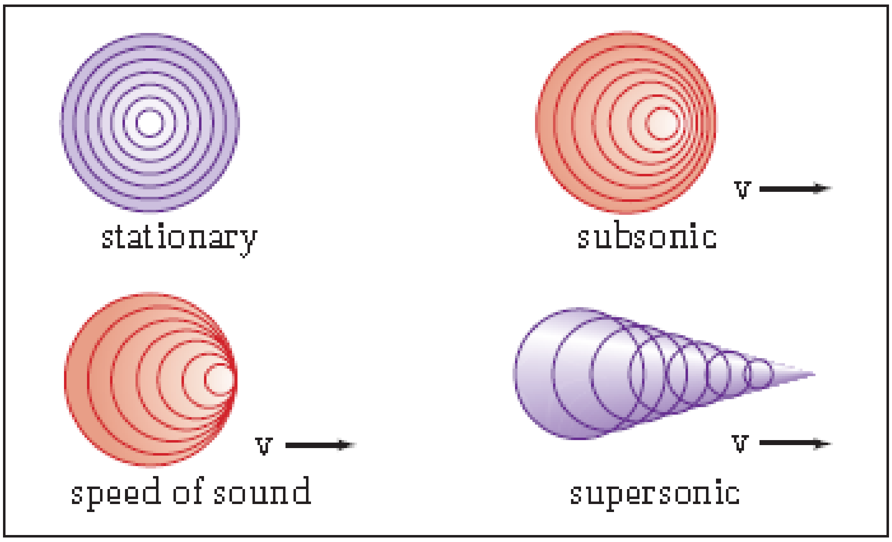


Figure 9.19 Sound waves propagating outward from a source moving at various speeds

Feb 12-5:54 PM

Figure 9.18 The shock wave as a jet breaks the sound barrier is visible because the increased pressure causes water vapour to condense.

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